EVAPORATOR FOR A REFRIGERATION APPLIANCE

Field of the Invention

The present invention refers to an evaporator for a refrigeration appliance, for example of the type used in a refrigeration circuit of refrigerators and freezers and other refrigeration appliances. The invention is particularly related to an evaporator comprising an assembly of tubes arranged in series, through which a refrigerant fluid is forced to pass.

Prior Art

Several evaporators known in the art use tubes made of steel, aluminum, copper or plastic material to conduct the refrigerant fluid, which exchanges heat with a secondary surface or with the air, in order to refrigerate the air in contact with the evaporator or with the loads deposited in an ambient refrigerated by said evaporator.

There are several evaporator constructions which utilize these tubes, such as the evaporators of the tube-fin, tube-wire, and tube-plate types. In order to simplify manufacture, these evaporators are produced with a constant tube diameter. The internal area of the tube is selected so as to allow a good heat exchange without the refrigerant fluid flow being submitted to a high load loss, i.e., to a high pressure loss between the inlet and the outlet of the evaporator, resulting from the attrition of the refrigerant fluid flow with the walls and from the density variation of the refrigerant fluid.

In an evaporator, the refrigerant fluid in the inlet contains a great amount of liquid. As the refrigerant fluid absorbs the heat and flows through the evaporator, the liquid is progressively transformed in vapor and the volume occupied by the refrigerant fluid (its specific volume) is progressively considerably

increased. In order to maintain the flow rate, the refrigerant fluid significantly accelerates and the high speed tends to produce a higher load loss, making the system lose efficiency.

When a constant tube diameter is used, this diameter has to be selected so as to minimize both the load loss and the performance loss. Since the highest the amount of vapor existing in the flow (which significantly increases its speed) the higher the load loss, a constant diameter conducts to oversize part of the evaporator that contains a significant portion of refrigerant fluid in a liquid state and which flows at low speed.

Objects of the Invention

By reason of the disadvantages mentioned above, it is an object of the present invention to provide an evaporator of low cost and which presents less load loss and better performance.

Summary of the Invention

This and other objects of the present invention are achieved through an evaporator for a refrigeration appliance, comprising a tube extension presenting an inlet for the refrigerant fluid in liquid state and an outlet for the refrigerant fluid in gaseous state, said tube extension comprising at least two tube portions, arranged in series and having different diameters and which are dimensioned to guarantee, to the refrigerant fluid flow, a more uniform speed along the different tube portions, without altering the flow rate of this refrigerant fluid between the inlet and the outlet of the tube extension.

Brief Description of the Drawings

The invention will be described below, with reference to the enclosed drawings, in which:

Figure 1 is a front schematic view of the tubular

development of an evaporator constructed according to the present invention;

Figure 2 is an enlarged lateral view of a possible construction for a transition region between two tube portions presenting different diameters and arranged in series; and

Figure 3 is an enlarged lateral view of another possible construction for a transition region between two tube portions presenting different diameters and arranged in series.

Description of the Illustrated Embodiment

In order to comply with the proposed objects, the evaporator of the present invention comprises a tube extension 10, presenting an inlet 11 for the refrigerant fluid in liquid state and an outlet 12 for the refrigerant fluid in gaseous state, said tube extension 10 being formed by at least two tube portions 10a, 10b with different diameters and which are connected in series, in order to conduct a refrigerant fluid from the refrigerating system to which the evaporator is operatively associated, the different diameters being dimensioned to guarantee, to the refrigerant fluid flow, a more uniform speed along the different tube portions, without altering the flow rate of this refrigerant fluid between the inlet 11 and the outlet 12 of the tube extension 10.

The dimensioning of the diameter for each tube portion 10a, 10b is determined so that said diameter is progressively increased as the refrigerant fluid is conducted from the inlet 11 to the outlet 12 of the tube extension 10 of the evaporator.

According to the present invention, the connection between each two tube portions 10a, 10b arranged in series and having different diameters is made through a transition region 20, whose diameter varies between

those diameters of the tube portions 10a, 10b to which it is interconnected.

In a constructive alternative, at least one transition region 20 has a diameter that varies, gradually, between the different diameters of the tube portions 10a, 10b which said transition region is interconnecting. In a constructive option of this alternative illustrated in figure 2, at least one transition region 20 is substantially frusto-conical.

In another constructive alternative illustrated in figure 3, at least one transition region is in the form of an annular tube portion, disposed orthogonal to the axis of the tube portions 10a, 10b, to which it is interconnected and determining, for example, an abrupt diameter variation between said tube portions 10a, 10b.

The utilization of two or more diameters for different tube portions in the construction of these evaporators allows reducing the production cost of the evaporator, improving the performance thereof.

The present invention provides the following benefits: reducing the refrigerant fluid load of the system, by reducing the internal volume of the evaporator; moderately increasing the speed of the refrigerant fluid in the initial regions of the evaporator, increasing heat transfer without increasing load loss thereof; improving the performance of the system as a whole.

In a constructive option, one of the tube portions 10a, 10b, such as the one used in the first 50% of the circuit of the evaporator, from the inlet of its tube extension 10, presents a smaller internal diameter, for example of about 5.3mm, and the tube portion 10b disposed in the region of the outlet 12 of the tube extension 10 presents an internal diameter of 6mm.

In another exemplificative construction (not illustrated), adjacent to the inlet 11 of the tube extension 10 and in front of the tube portion 10a, another tube portion is connected with an internal diameter, which is smaller than that of the tube portion 10a and occupying, for example, an inlet region inferior to 30% of the refrigerant circuit.

In any of the possible constructions, the junction between the tube portions 10a, 10b of different diameters, or between these and the transition regions 10 which interconnect them, is made by known means, such as welding, brazing, or other type of available mechanical junction.

The inventive concept of the present construction can be used in different evaporator constructions, such as the evaporators of the tube-fin, tube-wire and tube-plate types, by varying the diameters of the tube portions which form the tube extension of the evaporator, increasing said diameters as the refrigerant fluid flows along the circuit, changing from the liquid phase to the vapor phase. The construction proposed herein is particularly advantageous for the evaporators to be applied to refrigeration appliances of the "no frost" type.